Docket: GOSSAMER-2C

METHOD AND APPARATUS FOR CLADDING ELONGATED STRUCTURAL MEMBERS

ABSTRACT OF THE DISCLOSURE

A method and apparatus for the attachment of sheet cladding and other thin surfaces to structural frame members such as in space frames and other lattice structures. A batten assembly may be either partially integrated into an elongated structural member or attached by fasteners. A batten receiver provides a pair of sheet margin receiving channels and a fastener guide channel. The batten receiver may be integrated into the surface of the elongated structural member which for example, may be a tubular member or I-beam. The mating batten comprises shoulders which are essentially congruent to the receiving channels. Between the shoulders, an elongated recess mates with a pair of guide walls in the receiver. A fastener such as a metal screw having a cutting tip, may be installed through the recess and the guide channel and into the wall of the elongated structural member to provide secure connection of the batten members to one another. The shoulder and receiving channels receive the sheet margins in compressive engagement. The invention herein permits the cladding of elongated structural members in an aesthetically pleasing flush mounting configuration which allows for water run-off from the cladding sheet surfaces. The invention also provides an advantageous hidden round seal configuration which while also being aesthetically more pleasing, is also more protective of the seal integrity. This invention also provides batten attachments of sheet cladding and other thin surfaces to elongated members of a tubular cross-section.

BACKGROUND OF THE INVENTION

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. Serial No. 10/087,639 filed March 1, 2002 and claims priority therefrom.

FIELD OF THE INVENTION

The present invention relates generally to the field of structural design and more specifically to attachment of cladding surfaces to elongated structural members such as for creating large volume enclosures.

BACKGROUND ART

An example of conventional dome construction is illustrated in U.S. Patent No. 3,909,994 to Richter. This construction employs structural frame members arranged in a polygonal pattern forming framed openings. These openings are covered with thin sheet material to provide an enclosure without openings. The edge margins of the sheet material are locked and retained by retainer members which incorporate flanged gasket elements to seal the sheets to the structural frame members. The flanged structural members and the sheet margins are connected to hub members. The sheets are connected to the structural members by bar portions which clamp down on the sheet margins curved to form flanges. Because the bar portions extend above the sheet surfaces, each sheet is surrounded by an elevated perimeter and exposed gaskets. This configuration is typical of prior art structures where a cladding sheet is affixed to a system of frame members with flanges.

One significant disadvantage of such prior art is that the elevated perimeter around respective sheet surfaces creates a barrier to water drainage thereby promoting collection of rain water and the like. This promotes corrosion, mildew, dirt accumulation and other forms of deterioration which can be detrimental to the function and appearance of the structure.

Another significant disadvantage is the limitation of the use of the batten and receiver cladding system to flanged structural members only. This limitation leaves out elongated members with a tubular cross-section.

Another disadvantage is the exposure of the sealing gasket to the ambient environment above the frame members. This often means exposure to the outside elements such as extreme temperatures and moisture including pooled rain water as noted above. Such exposure can reduce gasket effectiveness, permit leakage and require frequent and costly maintenance. Moreover, the prior art sealing gasket is irregularly shaped and specifically configured.

Based upon the foregoing, it can be readily observed that there is a need for an improved way of affixing cladding surfaces to tubular and flanged elongated structural members to overcome the deficiencies of the prior art. More specifically, it would be a significant improvement to provide a flush-mounted cladding connection apparatus which would obviate elevated sheet perimeters that would otherwise interfere with water drainage. It would be a major improvement to provide a batten and receiver cladding connection for elongated members with a tubular cross-section. It would also be a welcome improvement to provide a design where the elastomeric seal or gasket is a simple round or O-ring type cross-section and is not exposed to the outside elements so that the gasket life is greatly improved. These improvements would be particularly useful in a frame structure which employs tubular structural members such as those disclosed in U.S. Patent No. 5,956,917 to Reynolds , a co-inventor hereof.

SUMMARY OF THE INVENTION

The present invention meets the aforementioned needs and provides the desired improvements for the attachment of sheet cladding and other non-load bearing thin surfaces to structural frame members such as in space frames and other lattice structures. The present invention may also be used advantageously to provide ceilings, or inverted roofs where the structural members are located above an underlying uninterrupted surface. The invention may also be provided in certain embodiments for use in connecting aluminum sheeting to steel structural members without substantial contact between the dissimilar metals. Other embodiments find utility where thermal or electrical isolation is needed between structural members and cladding or other sheet material.

A principal feature of the preferred embodiments of the invention comprises a unique batten configuration which may be either partially integrated into an elongated structural member or attached by fasteners. A batten receiver provides a pair of sheet margin receiving channels and a fastener guide channel. The batten receiver may be integrated into the surface of the elongated structural member which for example, may be a tubular member or I-beam. The mating batten comprises shoulders which are essentially congruent to the receiving channels. Between the shoulders, an elongated recess mates with a pair of guide walls in the receiver. A fastener such as a metal screw having a cutting tip, may be installed through the recess and the guide channel and into the wall of the elongated structural member to provide secure connection of the batten members to one another. The shoulder and receiving channels receive the sheet margins in compressive engagement. Retention strips commonly referred to as a "cat's paw" may be optionally provided on the mating shoulder and channel surfaces to provide added security in retaining the sheet therebetween. The mating batten is uniquely configured to be flush with the cladding sheet to obviate water run-off barriers

and to provide an aesthetically pleasing interface. Moreover, the mating batten provides a seal receptacle for receiving an elongated elastomeric O-ring seal that is isolated from the exposed surface of the batten so that the seal is not exposed to the environment. It will thus be seen hereinafter, that the present invention provides a number of unique and highly advantageous features with the principal object of overcoming the aforementioned deficiencies of the prior art. More specifically, the invention herein permits the cladding of elongated structural members in an aesthetically pleasing flush mounting configuration which allows for water run-off from the cladding sheet surfaces. The invention also provides a batten and receiver cladding connection for elongated members with a tubular cross-section. The invention also provides an advantageous hidden round seal configuration which while also being aesthetically more pleasing, is also more protective of the seal integrity and does not need to be uniquely configured for this particular apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned objects and advantages of the present invention, as well as additional objects and advantages thereof, will be more fully understood hereinafter as a result of a detailed description of a preferred embodiment when taken in conjunction with the following drawings in which:

FIG. 1 is a three-dimensional view of an I-beam comprising a partially integrated batten design in accordance with a preferred embodiment of the invention;

FIG. 2 is a cross-sectional view of the improved I-beam of FIG. 1;

FIG. 3 is a cross-sectional view of a tubular structural member comprising a partially integrated batten design similar to that of FIG. 1 but also illustrating the mating batten, cladding and a fastener of a preferred embodiment;

FIG. 4 is similar to FIG. 3 but showing the batten fully secured to the tubular member by the fastener and engaging the cladding sheet margins;

FIG.5 is a three-dimensional view of the tubular member/cladding arrangement of FIG. 4 with the cladding and batten partially removed;

FIG. 6 is a cross-sectional view of an alternative embodiment of the invention employing a non-integrated or "split batten" wherein both batten members are separated from the underlying structural member and connected to the structural member by a standoff device affixed to both the batten receiver and the structural member;

FIG. 7 is a cross-sectional view of the split batten upper portion;

FIG. 8 is a cross-sectional view of the split batten lower portion;

FIG. 9 is a three dimensional view of the embodiment of FIG. 6 with the cladding, batten and tubular structural member partially removed; and

FIG. 10 is a three-dimensional view of yet another embodiment of the invention which is particularly usefully for thermally or electrically isolating the cladding from the elongated structural member.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring initially to FIGs. 1 and 2, it will be seen that in a first embodiment 10 of the invention, an I-beam 12 has integrated therewith a cladding batten receiver 14. The receiver comprises a pair of shoulders 16 and a pair of guide walls 18. A receiving channel 20 is formed between each shoulder and an adjacent guide wall. The channel 20 is preferably U-shaped having an inclined planar side 17 leading into the curved or arched channel. This shape facilitates receiving a gently bent and curved cladding sheet margin as will become more evident hereinafter. The pair of guide walls 18 form a fastener guide channel 22 between them for receiving and guiding a fastener as will be also made more clear below.

Referring to FIGs. 3,4 and 5, it will be seen that a first alternative embodiment 25 is similar to the embodiment of FIGs. 1 and 2, but implemented in a tubular elongated member 26 instead of flanged elongated members as found in the prior art. More specifically, a batten receiver 28 is integral to the tube wall and comprises shoulders 30 and guide walls 32 and has a pair of receiving channels 34. Similarly, a batten 36 has a pair of rounded ridges 38 which are substantially congruent to channels 34. Batten 36 also comprises a pair of seal receptacles 40 each designed to retain an elongated O-ring elastomeric seal 42. A fastener 46 is received in a guide channel 44 and extends through the wall of the tubular structural member 26. When the batten 36 is compressed into engagement with the batten receiver 28 by the fastener 46 as depicted in FIG. 4, the margins of cladding sheets 45 are trapped therebetween with the elastomeric seal 42 compressed against the sheet. Moreover, as also seen in FIG. 4 as well as FIG. 5, the upper surface of batten 36 lies substantially flush (i.e., in co-planar relation) with cladding sheets 45 to permit unobstructed water run-off without any elevated barriers such as found in relevant prior art.

Another alternative embodiment 55 is shown in FIGs. 6 through 9. This embodiment is particularly useful where the elongated member and the batten components and cladding are made of dissimilar metals.

For example, if the tubular structural member 56 were made of steel, an aluminum batten assembly 58 can be affixed by means of a standoff stud 66 having a shoulder 68. Moreover, the cladding 64 may be aluminum sheeting. Thus, this embodiment permits aluminum cladding of steel structural members. The batten assembly 58 of this embodiment is substantially similar to that of the FIG. 5 embodiment with one major distinction. Batten receiver 60 is an independent component and is not an integral part of the tubular member 56. In all other respects, the batten assembly 58 is identical to that of the integral embodiments. Specifically, a batten 62 has a pair of shoulders 63 which are substantially congruent to channels 61 of batten receiver 60. A guide channel 67 is provided to direct a fastener into stud 66.

FIG. 9 also depicts a technique for splicing cladding members to one another without attachment to a structural member. For example, if it were required to join two cladding sheets to fill a space between structural members, the non-integral batten 60/62 of FIGs. 6-9, would enable such joining.

Yet another embodiment 75 is illustrated in FIG. 10. This embodiment is particularly useful where it is desired to either thermally or electrically isolate the cladding 70 from the tubular structural member 72. The lower batten member 74 may be made of a selected insulating material such as a thermally and/or electrically non-conductive composite. The upper batten member 76 is secured by means of fasteners 77 and the lower batten member 74 is secured by fasteners 78 through apertures 80 and into the structural member 72.

Having the benefit of learning of a number of embodiments of the invention, it will be understood that still other embodiments as well as variations in those illustrated are contemplated. By way of example, while structural members comprising I-beams and circular tubes have been disclosed, it should be apparent that the invention may be employed for direct cladding of other shaped structural members, such as those having a triangular, square, rectangular or irregular cross-section or combinations thereof. Furthermore, while the disclosed embodiments illustrate generally planar cladding, the invention does not require use with flat sheets, but may be used with more complex surfaces such as convex, concave or non-uniform variations in shapes and thicknesses.

Accordingly, those having skill in the relevant art will perceive various modifications and additions which may be readily made to the disclosed versions. However, such modifications and additions may be within the scope of the invention which is limited only by the appended claims and their equivalents.

We claim: